

FORM PTO-1449 U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE INFORMATION DISCLOSURE STATEMENT BY APPLICANT (USE SEVERAL SHEETS IF NECESSARY)	ATTY. DOCKET NO. ASMMC.003DV1	APPLICATION NO. Unknown
	APPLICANT Raaijmakers et al.	
	FILING DATE Herewith	GROUP Unknown

U.S. PATENT DOCUMENTS							
EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE (IF APPROPRIATE)
OK	1.	4,058,430	11/15/77	Suntola et al.	156	611	11/25/75
OK	2.	4,413,022	11/01/83	Suntola et al.	427	255.2	06/21/79
OK	3.	4,747,367	05/31/88	Posa	118	715	06/12/86
OK	4.	4,761,269	08/02/88	Conger et al.	422	245	06/12/86
OK	5.	5,674,781	10/7/97	Huang et al.	437	192	2/28/96
OK	6.	5,711,811	01/27/98	Suntola et al.	118	711	
OK	7.	5,879,459	3/9/99	Gadgil et al.			
OK	8.	5,904,565	5/18/99	Nguyen et al.			
OK	9.	5,916,365	6/99	Sherman			
OK	10	5,933,761	8/3/99	Lee	438	783	7/10/98
OK	11	6,037,258	3/14/00	Liu et al.	438	687	3/7/99
OK	12	6,048,790	4/00	Iacoponi et al.			
OK	13	6,069,068	5/30/00	Rathore et al.	438	628	10/8/97
OK	14	6,077,775	06/20/00	Stumborg et al.			
OK	15	6,083,818	07/04/00	Stumborg et al.			
OK	16	6,093,638	7/00	Cho et al.			
OK	17	6,100,184	8/00	Zhao et al.			
OK	18	6,139,700	10/31/00	Kang et al.	204	192.17	9/30/98
OK	19	6,146,517	11/14/00	Hoinkis	205	186	5/19/99
OK	20	6,181,012	1/30/01	Edelstein et al.	257	762	4/27/98
OK	21	6,184,128 B1	2/6/01	Wang et al.			
OK	22	6,188,134 B1	2/13/01	Stumborg et al.	257	751	8/20/98
OK	23	6,200,893	3/01	Sneh			
OK	24	6,203,613	3/02	Gates et al.			
OK	25	6,207,567	3/01	Wang et al.			

EXAMINER <i>Douglas K. Chen</i>	DATE CONSIDERED <i>10/14/04</i>
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OKO	26	6,225,213	5/01	Urabe			
OKO	27	6,270,572 B1	8/7/01	Kim et al.			
OKO	28	6,287,965	9/11/01	Yokoyama et. Al.	438	624	4/23/98
OKO	29	6,303,523	10/16/01	Cheung et al.			
OKO	30	6,342,448	1/2	Lin et al.			
OKO	31	6,358,829 B2	03/2002	Yoon et al.	438		
OKO	32	6,351,039 B1	02/2002	Jin et al.	257		
OKO	33	6,368,954 B1	4/9/02	Lopatin et al.	438	627	7/28/00
OKO	34	6,482,733	11/02	Raaijmakers et al.			
OKO	35	US 2001/001742 A1	5/24/01	Huang et al.	438	710	12/18/98
OKO	36	US 2001/0034123 A1	10/25/01	Jeon et al.	438	643	4/6/01

FOREIGN PATENT DOCUMENTS								
EXAMINER INITIAL		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION	
							YES	NO
	37.	DE 196 37 017 A1	1/9/97	Germany				
	38.	DE 198 20 147 A1	1-7-99	Germany				
	39.	KR 2000054970	1999	Korea				
	40.	JP 2001217206 A2	8/10/01	Japan				
	41.	WO 96/17107	06/06/96	PCT				
OKO	42.	WO 99/41423	19.08.99	PCT				
OKO	43.	WO 9962109	12/1/99	PCT				
OKO	44.	WO 0013207A2	3/9/00	PCT				
OKO	45.	WO 0015866A1	3/23/00	PCT				
OKO	46.	WO 0015881A2	3/23/00	PCT				
OKO	47.	WO 0016377A2	3/23/00	PCT				

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OK	48.	WO 0022659A1	4/20/00	PCT				
OK	49.	WO 0055895A1	9/21/00	PCT				
OK	50.	WO 0063957A1	10/26/00	PCT				
OK	51.	WO 0079576A1	12/28/00	PCT				
OK	52.	WO 0136702A1	5/15/01	PCT				
OK	53.	WO 0145149A1	6/21/01	PCT				
OK	54.	WO 0178123A1	10/18/01	PCT				
OK	55.	WO 0011721	3/02/00	PCT				
OK	56.	WO 0075964 A2	12/14/00	PCT				
OK	57.	WO 0115220	3/01/01	PCT				
OK	58.	WO 0166832	9/13/01	PCT				
OK	59.	WO 0178124A1	10/18/01	PCT				
OK	60.	WO 0199166A1	12/27/01	PCT				

EXAMINER INITIAL	OTHER DOCUMENTS (INCLUDING AUTHOR, TITLE, DATE, PERTINENT PAGES, ETC.)	
OK	61.	B. Abeles and T. Tiedje, "Amorphous Semiconductor Superlattices," <u>Physical Review Letters</u> , 21 November 1983, Vol. 51, No. 21, pp. 2003-2006
OK	62.	Bedair, S.M. "Selective area and sidewall growth by atomic layer epitaxy" <u>Semicond Sci. technol.</u> Vol 8:1052-1062 (1993)
OK	63.	Csaba Döscö, Nguyen Quoc Khanh, Zsolt Horváth, and István Bárony, Research Institute for Materials Science - ATKI, H-1525 Budapest, Hungary; Mikko Utriainen, Sari Lehto, Minna Nieminen, and Lauri Niinistö, Laboratory of Inorganic and Analytical Chemistry, Helsinki University of Technology, FIN-02150 Espoo, Finland, "Deposition of Tin Oxide into Porous Silicon by Atomic Layer Epitaxy," <u>J. Electrochem. Soc.</u> , February 1996, Vol. 143, No. 2, pp. 683-687
OK	64.	P.C. Fazan, V.K. Mathews, N. Sandler, G.Q. Lo, and D.L. Kwong, "A High-C Capacitor (20.4 fF/μm ²) with Ultrathin CVD - Ta ₂ O ₅ Films Deposited on Rugged Poly-Si for High Density DRAMs," <u>IEEE</u> , 1992, pp. IDEM 92-263-IDEM 92-266
OK	65.	George et al. "Atomic layer deposition of tungsten on oxide surfaces" <u>Book of Abstracts</u> , 219 th ACS Nat'l Meeting, SF, CA March 26-30 2000 published by American Chemical Society, Washington D.C.
OK	66.	L. Hiltunen, M. Leskelä, M. Mäkelä, L. Niinistö, E. Nykänen and P. Soininen, "Nitrides of Titanium, Niobium, Tantalum and Molybdenum grown as Thin Films by the Atomic Layer Epitaxy Method," <u>Thin Solid Films</u> , 1988, Vol. 166, pp. 149-154.
OK	67.	Y. Horiike, T. Ichihara, and H. Sakaue, "Filling of Si oxide into a deep trench using digital CVD method," <u>Applied Surface Science</u> , 1990, Vol. 46, pp. 168-174
OK	68.	Juppo et al. "Deposition of copper films by an alternate supply of CuCl and Zn" <u>J. Vac. Sci. Technol.</u> A 15(4):2330 (1997)

EXAMINER	<i>Rough k. Omer</i>	DATE CONSIDERED	<i>10/14/04</i>
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DKG	69.	Takeshi Kaizuka, Hiroshi Shinriki, Nobuyuki Takeyasu, and Tomohiro Ohta, "Conformal Chemical Vapor Deposition TiN(111) Film Formation as an Underlayer of Al for Highly Reliable Interconnects," <u>Jpn. J. Appl. Phys.</u> , 1994, Vol. 33, pp. 470-474.
DKG	70.	Takamaro Kikkawa, Hidemitsu Aoki, Eiji Ikawa, and John M. Drynan, "A Quarter-Micrometer Interconnection Technology Using a TiN/Al-Si-Cu/TiN/Al-Si-Cu/TiN/Ti Multilayer Structure," <u>IEEE Transaction on Electron Devices</u> , February 1993, Vol. 40, No. 2, pp. 296-302
DKG	71.	T. Kikkawa and K. Kikuta, "Al-Si-Cu/TiN multilayer interconnection and Al-Ge reflow sputtering technologies for quarter-micron devices," <u>SPIE</u> , 1992, Vol. 1805, pp. 54-64.
DKG	72.	Kim et al., "Applicability of ALE Tin films as Cu/Si diffusion barriers" <u>Thin Solid Films</u> 372(1):276-283 (2000)
DKG	73.	Kim et al., "Comparison of TiN and TiAlN as a Diffusion Barrier Deposited by Atomic Layer Deposition" <u>Journal of the Korean Physical Society</u> 40(1), 176-179 (2002)
DKG	74.	Klaus et al., "Atomic LAYER Deposition of Tungsten Nitride Films Using Sequential Surface Reactions" <u>J. Electrochem Soc.</u> 147(3): 1175-1181 (2000)
DKG	75.	J.W. Klaus, O. Sneh, A.W. Ott and S. M. George, "Atomic Layer Deposition of SiO ₂ Using Catalyzed and Uncatalyzed Self-Limiting Surface Reactions". <u>Surface Review and Letters</u> , Vol. 6, Nos. 3 & 4 (1999) pp. 435-448.
DKG	76.	J.W. Klaus et al., "Atomically controlled growth of tungsten and tungsten nitride using sequential surface reactions," <u>Applied Surface Science</u> , Vols. 162-163, pp. 479-491 (2000).
DKG	77.	Koo et al., "Study on the characteristics of Ti AlN thin film deposited by atomic layer deposition method" <u>Journal of Vacuum Science & Technology, A: Vacuum Surfaces, and Films</u> 19(6), 2931-2834 (2001)
DKG	78.	Kaupo Kukli, Mikko Ritala, and Markku Leskelä, "Atomic Layer Epitaxy Growth of Tantalum Oxide Thin Films from Ta(OC ₂ H ₅) ₅ and H ₂ O," <u>J. Electrochem. Soc.</u> , May 1995, Vol. 142, No. 5, pp. 1670-1674.
DKG	79.	M. Leskelä and M. Ritala, "Atomic Layer Epitaxy in Deposition of Various Oxide and Nitride Thin Films," <u>Journal De Physique IV, Colloque C5, supplément au Journal de Physique II</u> , Juin 1995, Vol. 5, pp. C5-937-C5-951
DKG	80.	Martensson et al., "Atomic layer pitaxy of copper" an ab initio investigation of the CuCl/H ₂ process III. Reaction barriers" <u>Appl. Surf. Sci.</u> 157(1):92-100 (2000)
DKG	81.	Martensson et al. "CU(THD) as Copper Source in Atomic Layer Epitaxy" <u>Proc. Electrochem. Soc.</u> 97-25:1529-1536 (1997)
DKG	82.	P. Martensson et al., "Atomic Layer Epitaxy of Copper on Tantalum," <u>Chemical Vapor Deposition</u> , Vol. 3, No. 1, pp. 45-50 (1997).
DKG	83.	Per Martensson; Marika Juppo, and Jan-Otto Carlsson, "Use of atomic layer epitaxy for fabrication of Si/TiN/Cu structures," <u>J. Vac. Sci. Technol. B</u> , September/October 1999, Vol. B 17, No. 5, pp. 2122-2128
DKG	84.	Per Martensson and Jan-Otto Carlsson, "Atomic Layer Epitaxy of Copper, Growth and Selectivity in the Cu(II)-2,2,6, 6-tetramethyl-3,5-heptanedionate/H ₂ Process," <u>J. Electrochem. Soc.</u> , Vol. 145, No. 8, August 1998, pp. 2926-2931
DKG	85.	Jae-Sik Min, Young-Woong Son, Won-Gu Kang, Soung-Soon Chun, and Sang-Won Kang, "Atomic Layer Deposition of TiN Films by Alternate Supply of Tetrakis (ethylmethylamino)-Titanium and Ammonia," <u>Japanese Journal of Applied Physics</u> , 1998, Vol. 37, pp. 4999-5004.
DKG	86.	Jae-Sik Min, Young-Woong Son, Won-Gu Kang, and Sang-Won Kang, "Atomic Layer Deposition of TiN Thin Films by Sequential Introduction of Ti Precursor and NH ₃ ," <u>Materials Research Society</u> , 1998, Vol. 514, pp. 337-343.
DKG	87.	Jae-Sik Min, Hyung-San Park, Wonyong Koh, Sang-Won Kang, "Chemical Vapor Deposition of Ti-Si-N Films with Alternating Source Supply, <u>Mat. Res. Soc. Symp. Proc.</u> Vol. 564, 1999 Materials Research Society, pp. 207-210
DKG	88.	Jae-Sik Min et al., "Metal-organic atomic-layer deposition of titanium-silicon-nitride films," <u>Applied Physics Letters</u> , Vol. 75, No. 11, pp. 1521-1523 (1999).
DKG	89.	Moeller, Preben J., "Copper and nickel ultrathin films on metal-oxide crystal surfaces" <u>Mater. Soc. Monogr.</u> 81:473-522 (1994)
DKG	90.	Lauri Niinistö, Mikko Ritala, Markku Leskelä, "Synthesis of oxide thin films and overlayers by atomic layer epitaxy for advanced applications," <u>Materials Science and Engineering</u> , 1996, Vol. B41, pp. 23-29.

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DLG	91.	Ritala et al. "Effects of intermediate zinc pulses on properties of TiN and NbN films deposited by atomic layer epitaxy" <u>Appl. Surf. Sci.</u> 120:199-212 (1997)
DLG	92.	Mikko Ritala, Pia Kalsi, Diana Riihelä, Kaupo Kukli, Markku Leskelä, and Janne Jokinen, "Controlled Growth of TaN, Ta ₃ N ₅ , and TaO _x N _y Thin Films by Atomic Layer Deposition," <u>Chem. Mater.</u> , 1999, Vol. 11, pp. 1712-1718
DLG	93.	Mikko Ritala, Markku Leskelä, Eero Rauhala, and Janne Jokinen, "Atomic Layer Epitaxy Growth of TiN Thin Films from TiI ₄ and NH ₃ ," <u>J. Electrochem. Soc.</u> , August 1998, Vol. 145, No. 8, pp. 2914-2920.
DLG	94.	Mikko Ritala, Markku Leskelä, Jan-Pieter Dekker, Cees Mutsaers, Pekka J. Soininen, and Jarmo Skarp, "Perfectly Conformal TiN and Al ₂ O ₃ Films Deposited by Atomic Layer Deposition," <u>Chem Vap. Deposition</u> , 1999, Vol. 5, No. 1, pp. 7-9
DLG	95.	Rosnagel et al., "Plasma-enhanced atomic layer deposition of Ta and Ti for interconnect diffusion barriers" <u>J. Vac. Sci. Technol.</u> 18(4):2016-2020 (2000)
DLG	96.	Hiroyuki Sakaue, Masayuki Nakano, Tsutomu Ichihara, "Digital Chemical Vapor Deposition of SiO ₂ Using a Repetitive Reaction of Triethylsilane/Hydrogen and Oxidation," <u>Japanese Journal of Applied Physics</u> , January 1990, Vol. 30, No. 1B, pp. L124-L127
DLG	97.	O. Sneh, M.L. Wise, A.W. Ott, L.A. Okada, and S.M. George, "Atomic layer growth of SiO ₂ on Si(100) using SiCl ₄ and H ₂ O in a binary reaction sequence," <u>Surface Science</u> , 1995, Vol. 334, pp. 135-152
DLG	98.	Solanki et al., "Atomic Layer Deposition of Copper Seed Layers" <u>Electrochem. and Solid State Lett.</u> 3(10): 479-480 (2000)
DLG	99.	Utriainen et al., "Studies of metallic thin film growth in an atomic layer epitaxy reactor using M(ACAC) ₂ (M=Ni,Cu, Pt) precursors" <u>Appl. Surf. Sci.</u> 157(3):151-158 (2000)
DLG	100.	Michael L. Wise, Ofer Sneh, Lynne A. Okada, Anne C. Dillon, and Steven M. George, "Diethyldiethoxysilane as a New Precursor for SiO ₂ Growth on Silicon, <u>Mat. Res. Soc. Symp. Proc.</u> , 1994, Vol. 334, pp. 37-43

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